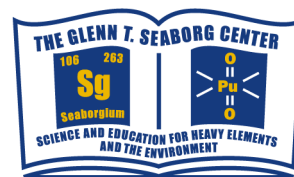




Glenn T. Seaborg Center Seminar



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Demonstration of a Massive Magnetic Field Induced Structural Transformation in the $\text{Gd}_5\text{Si}_x\text{Ge}_{4-x}$ Phases

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Building 70A-3377

Abstract

Changes in the bonding character between atoms of intermetallic systems are often concomitant with temperature and/or pressure induced polymorphism. A change in crystal structure in response to a variation in either of these thermodynamic parameters generally serves to minimize the free energy of the system. Synthetic diamond, obtained from ordinary graphite at high pressure and elevated temperature, is the best-known example of this type of polymorphism. A similar effect has been proposed to occur in other systems by varying an applied magnetic field in a bulk magnetic field dependent measurement such as field dependent electrical resistance, magnetization, heat capacity, and strain (magnetostriction). Although these experimental techniques are able to provide suitable information on a macroscopic level, they are limited in the direct identification of the atomic scale mechanism that drives the structural transition. The importance of gaining atomic-scale structural and bonding information of a magnetic field induced structural transition (FIST) has become a necessity in facilitating a better understanding of the magnetic field induced temperature variations that are responsible for such material properties as the magnetocaloric effect. Substantial magnetic field induced structural changes occurring in the family of the giant magnetocaloric $\text{Gd}_5\text{Si}_x\text{Ge}_{4-x}$ materials have been imaged at the atomic length scale by *in situ* X-ray powder diffraction carried out in the temperature range between 5 and 320 K and in dc magnetic fields up to 35 kOe. The results from these studies will be presented demonstrating the ability to image magnetic field induced structural changes at the atomic scale by using *in situ* X-ray powder diffraction.